

of half shoes by farm-workers has reduced infection to less than one-tenth of the usual rate suffered by those who did not wear shoes.

Only a few outstanding points in this valuable report have been cited, but enough has been given to show that in hookworm disease we have a notable illustration of the close connexion between elementary sanitation and the prevention of disease. In England we associate this connexion chiefly with diarrhoea and enteric fever, and William Budd's researches will always furnish the classical illustration of the close relations between defective latrine accommodation and the spread of infection as soon as typhoid fever is introduced into a village. The association is probably wider than is usually suspected. The relation of excessive diarrhoea to the continuance of conservancy systems in English towns and villages has been repeatedly emphasised, and there is strong reason for assuming a similar association of these systems with excessive pneumonia in young children.

But the hookworm story emphasises even more the importance of exact knowledge of the infecting agent. The provision of shoes or even their compulsory wearing is a novelty in sanitary administration from a British point of view; but it appears to be the most urgent need where hookworm disease is endemic. So, likewise, the fact that hookworm disease is an occupational disease shows where preventive work is chiefly needed, while the distinction between incidental infection and actual disease points to the persons among whom administrative control must be chiefly attempted. These contentions are illustrated in the paper by the wasted effort displayed in such public health work as the "swat-the-fly" campaign, in which a vast amount of effort and much money are expended in fruitless endeavours to eliminate flies by wholly illogical methods.

The Vegetation of High Asia.

Southern Tibet: Discoveries in Former Times compared with my own Researches in 1906-1908. By Sven Hedin. II. *A List of Flowering Plants from Inner Asia, collected by Dr. Sven Hedin, determined by various authors, and compiled by C. H. Ostenfeld and Ove Paulsen.* Pp. 25 + 100 + 8 plates. (Stockholm: Lithographic Institute of the General Staff of the Swedish Army, 1922.) 30 marks.

KNOWLEDGE of the vegetation of High Asia is now extensive. The climate, while leaving something to be desired in other respects, favours the preparation of botanical specimens, and travellers in the inclement uplands of Tibet and the Pamirs have supplied much material for herbarium use. Yet,

owing to circumstances beyond their control, this material compares unfavourably with that secured by explorers in temperate and tropical regions. As a result, our acquaintance with the flora of High Asia is still far from exhaustive.

Geographical reconnaissance involves the investigation of as much ground as an expedition can map, and is thus somewhat incompatible with an intensive study of the vegetation of a given area throughout a round of the seasons. Any combination of the two activities means either that geography must be content with fewer data, or that botany must rest satisfied with indifferent material. The best botanical results of geographical expeditions are obtained during halts made when plants are in active growth.

The traveller in temperate regions may arrange his halts. In the tropics, as in high latitudes and at great altitudes, halts usually depend on meteorological conditions. Those caused by heat or rain coincide with periods of vegetative activity; those due to cold and snow occur when plants are dormant. The arctic-alpine flowering season is, besides, so brief that when the explorer sets out he may find only leaf-specimens; ere his journey ends, he may collect only specimens of plants the seeds of which have fallen. He may, if fortunate, secure complete material of species general along his route but he must be prepared for the possibility that his specimens of local plants are not always identifiable.

The botanical interest in any collection of plants from High Asia is therefore intelligible. Underlying this interest is a hope that new material may resolve old doubts. That hope explains our attitude towards arctic and alpine collections as compared with those from temperate latitudes or moderate elevations. A difference of a few days in the dates on which particular arctic or alpine camping-grounds were visited may give assurance to identifications originally tentative. The value of any High Asian collection is thus enhanced if it comes from districts already carefully investigated.

The importance of a census of the flowering plants found by Dr. Sven Hedin in the course of his various journeys in Inner Asia during 1894-1907 will therefore be readily appreciated. This census, compiled by workers so careful and competent as Prof. C. H. Ostenfeld and Dr. O. Paulsen, affords concrete evidence of the effects upon botanical survey of the exigencies of geographical exploration at great heights, and exemplifies the disadvantages against which the traveller on lofty uplands must contend.

The praiseworthy pains the authors have taken to identify many incomplete specimens have been more than justified by their results. Notwithstanding their care, the compilers have felt debarred from suggesting

specific names in the case of eleven, or 4 per cent. of the 275 plants enumerated. If to these we add the cases in which specific determination remains more or less doubtful, we have a total of 27, or nearly 10 per cent. of the whole. The authors have laid those who may study this census under a lasting obligation by recording the precise condition of the material available and thereby indicating why, as well as where, doubt attaches to certain identifications.

The imperfection of much of Dr. Hedin's material has induced the authors to restrict themselves to a taxonomic enumeration of the plants actually found by that eminent traveller in East Turkestan, the Pamirs, and Tibet, and to regard their work as supplementary to that of Dr. Hemsley¹ and Madame Fedtschenko.² Other considerations may have weighed with workers who are recognised as authorities both on plant-distribution and plant-association, when deciding that phytogeographical or ecological discussion is not yet feasible.

The census shows that Dr. Hedin collected 57 distinct plants in East Turkestan, 72 in the Pamirs, and 185 in Tibet, but that two only of the plants enumerated were found by him in all three regions; only one not met with in Tibet was found both in East Turkestan and the Pamirs, and only eight not met with in the Pamirs are recorded both from East Turkestan and Tibet, while no fewer than 27 not met with in East Turkestan are recorded both from the Pamirs and Tibet.

These figures are not surprising when regard is had to the fact that all the Pamir plants were collected at elevations of 12,000-15,000 feet and all the Tibetan ones were found at elevations of 8500-17,000 feet, whereas 44 of the 57 plants reported from East Turkestan were met with at altitudes of only 2750-3500 feet. Conformity as regards elevation may account for the appreciable common element in the Pamir and the Tibet vegetations; disparity in this respect may explain the relative isolation of East Turkestan. That isolation may indeed be greater than the census suggests. All the East Turkestan plants reported from altitudes exceeding 3500 feet were found in one or other of three localities. The thirteen plants in question include one of the three recorded as common to East Turkestan and the Pamirs and seven of the ten recorded as common to East Turkestan and Tibet.

One of these three localities is Toghde-gol, 9100 feet, in southern Tsaidam. This locality is cited in the census for four plants. Only in the case of two of these is the place said to be in East Turkestan; under the

others it is said to be in Tibet. Another of the localities is Bash-kurgan, 8750 feet, south of Lop-nor, which is cited for five plants. In connexion with two of these the place is said to be in East Turkestan, under a third it is stated to be on the East Turkestan-Tibet frontier, and in connexion with the two remaining plants the locality is placed in Tibet. The third locality, Tatlik-bulak, 6500 feet, is mentioned in connexion with eight plants. Here we have no such formal inconsistency; on each occasion the place is attributed to East Turkestan. But this does not remove all doubt; Tatlik-bulak lies south-east of Lop-nor and therefore farther east than Bash-kurgan.

It is possible that this discrepancy of statement merely reflects a difference in point of view. In floristic studies it is often convenient to respect political boundaries; in phytogeographical ones it is always desirable to recognise natural frontiers. From an ethnic standpoint all three localities may belong to East Turkestan; the evidence of the plants themselves suggests that from a botanical standpoint all three belong to Tibet. However this may be, the census prepared by Prof. Ostenfeld and Dr. Paulsen appears to justify one general conclusion. While it is clear that East Turkestan can be properly included in the region our authors speak of as "Inner Asia," it must be excluded from the region for which Dr. Hemsley has employed the term "High Asia."

How deeply we are indebted to Dr. Paulsen for our acquaintance with the vegetation of the western Pamirs, the drainage of which is towards Ferghana and the Oxus, readers of NATURE are already aware. Regarding the plants of the eastern Pamirs, the streams of which flow towards Yarkand, we have hitherto known little beyond what was to be learned from a few specimens gathered by Sir F. E. Younghusband thirty years ago in the Pamir of Taghdumbash. All save one of the Pamir plants in Dr. Hedin's collections are reported from the eastern half of the region; the evidence they afford is thus of unusual importance.

Unfortunately, that evidence is still far from complete. From the Taghdumbash Pamir, which from its connexions to the south and the east should perhaps prove the most "critical" of these high valleys, we have again to be content with a few specimens. Nearly 30 per cent. of Dr. Hedin's Pamir plants are from the Karakul Pamir, probably the least critical of the eastern valleys. More than 40 per cent. were gathered on the slopes of Mustagh-ata, highest of the Pamir peaks, but in this case it is not clear that all the Mustagh-ata plants were collected in one Pamir. Until the vegetation of these various eastern Pamirs has been investigated as exhaustively as that of the Little Pamir was by Lt.-Col. Alcock during the Pamir

¹ The Flora of Tibet or High Asia: W. B. Hemsley, assisted by H. H. W. Pearson (Journ. Linn. Soc., Bot. vol. xxxv. pp. 124-265, 1920).

² Flore du Pamir: Olga Fedtschenko (Act. Hort. Petrop., vol. xxi. pp. 233-471, 1903; *ibid.* vol. xxiv. pp. 123-154, 1904; and pp. 313-355, 1905; *ibid.* vol. xxviii. pp. 97-126, 1907; and pp. 455-514, 1909).

Boundary Commission and as that of the Alichur Pamir was by Dr. Paulsen during the second Danish Pamir Expedition, the last word on the vegetation of this region as a whole must be left unsaid. The numbers of plants found by Dr. Hedin in all the eastern valleys visited by him falls short of the number which Lt.-Col. Alcock has taught us may be found in a single western one.

The evidence supplied by Dr. Hedin, imperfect though it be, does, however, sustain the general conclusion, based on our acquaintance with the vegetation of the western Pamirs, that while many plants are common to all, some are peculiar to each.³ Another general conclusion to which the material obtained by Dr. Hedin appears to point is that it may prove more convenient and natural to employ the term "High Asia," restricted by Dr. Hemsley to Tibet, in an extended sense which will include also the "Pamirs."

Tibet is by far the largest of the three regions visited by Dr. Hedin; he collected there twice as many plants as he found in the Pamirs, and three times as many as he gathered in East Turkestan. The plants from Tibet which the authors have been compelled to describe as new are five times as numerous as the new species reported from both of the other regions. The authors of this census are therefore fully justified in remarking that its main interest lies in the Tibetan plants therein discussed. These facts notwithstanding, it is more impossible to deduce conclusions regarding the vegetation of Tibet from the evidence here supplied than it is to do so in the case of East Turkestan or of the Pamirs. The phytogeographical indications are sometimes as inconsistent as in the case of East Turkestan and are, if possible, more inexplicable than they are as regards that region. Localities are at times placed in Inner Tibet with no indication of latitude or longitude, and therefore with only imperfect clues as to their precise situation. When more precise indications are supplied, Inner Tibet is now given as synonymous with Northern, anon as synonymous with Eastern Tibet. Certain localities are said in one case to be in North Tibet, in another to be in East Tibet. The list itself forms part of the sixth volume of a work entitled "Southern Tibet," yet it does not include any plant said to have been collected in South Tibet.

Perhaps the most interesting individual species in the list is one which Prof. Ostenfeld has proposed to treat as the type of a new genus, *Hedinia*. Though thus characterised, this plant, as it happens, is not a new discovery. It is one that so long ago as 1852 was referred by Dr. T. Thomson to the Cruciferous genus *Hutchinsia*, with the characters of which it conforms so indifferently that in 1861 it was transferred by Sir

J. D. Hooker to the genus *Capsella* as admittedly a very aberrant member. In 1904 Mr. W. Lipsky was so impressed by the unsatisfactory character of both these suggestions that he transferred the plant to the genus *Smelowskia*. With this particular genus, however, the plant has less natural affinity than it has with either *Capsella* or *Hutchinsia*. The treatment now accorded the plant by Prof. Ostenfeld is certainly more convenient than any hitherto proposed. It is to be hoped that it may also prove to be more natural and that it may provide a lasting memorial to the explorer whose name it is intended to perpetuate.

Alcohol as a Fuel.

Power Alcohol: Its Production and Utilisation. By G. W. Monier-Williams. Pp. xii + 323. (London: Henry Frowde and Hodder and Stoughton, 1922.) 21s. net.

THE enormous increase in the number of engines using motor spirit throughout the civilised world, and the demand for other products of mineral oil, have forcibly directed attention to the great problem of the world's reserves of oil, and to alternative sources of fuels suitable for engines where a fuel of high vapour pressure is necessary. Dr. Monier-Williams deals in his opening chapter with this big problem—the motor fuel question—in a very comprehensive and clear manner. It is shown that while in 1913 the import of petroleum spirit into the United Kingdom was 101 million gallons, by 1920 the imports had reached 200 million gallons. In the United States (where it is said that there is one motor car to every eight of the population) the motor spirit consumption rose from 1200 million gallons in 1914 to 2680 million gallons in 1918.

It is clear that this modern development of locomotion, together with the requirements for aviation, will make further and further demands upon Nature's not inexhaustible reserves of suitable fuel. Although much has been accomplished in rendering a greater proportion of the crude oil available as fuel, by widening the distillation range, by "cracking" heavier fractions, and by taking out the more easily condensable portions of natural gas ("casing head gasoline"), the world is undoubtedly faced with the big problem of Nature's reserves of oil and the possibility of alternative supplies of liquids of sufficiently high vapour pressure to supplement, or in the long run largely to replace, the motor spirit derived from crude petroleum. Dr. Monier-Williams says "a complete solution of the motor fuel problem can only be found in the opening up of extensive, and as yet unproved, new areas of supply, together with the introduction of fuels derived from other sources than petroleum."

³ NATURE, vol. cvii. p. 270 (April 28, 1921).